

Civil & Environmental Engineering

2023

Q1

Explain the principles of Surveying with the help of sketches?
~~also explain well conditioned & ill conditioned triangles~~

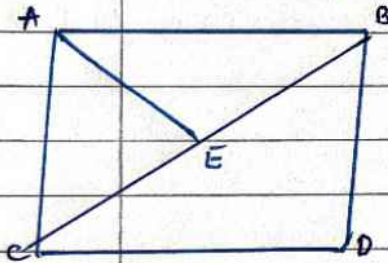
Ans

Surveying is the science and art of Determination of relative positions of various points above, on or below the surface of the earth.

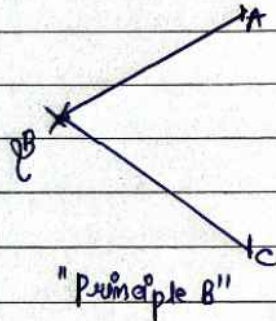
* Principles of Surveying

There are two principles of surveying, They are -

- (i) The survey work should be done/carried out from the "Whole to the part" & not from part to whole.
- (ii) The positions of New stations should be fixed by at least two independent processes or measurements.



Work is divided into triangle
"Principle"



→ Principle 1: The main idea of working from whole to part is to prevent accumulation of errors & to minimize localize minor error within the framework of the control points.

∴ On the other hand if the survey is carried out from the part to whole, the errors would be cumulating & the scale of survey would be distorted beyond control.

Principle 2: Two control points are selected in the area & the distance between them is measured accurately.

∴ "Posn" of the third point can be fixed by

- (i) Only linear Measurements
- (ii) Only angular Measurements
- (iii) Combination of linear & angular Measurements.

Q

Write short Notes on - 1) Compass Surveying
2) local attraction.

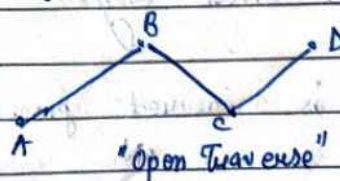
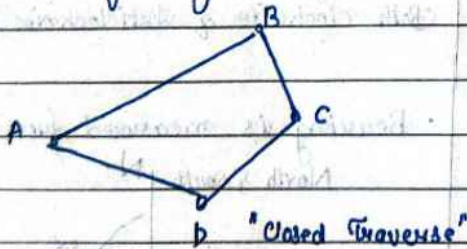
Ans

Compass Surveying: In a compass survey, The horizontal angles are measured with a Magnetic Compass, in addition to linear Measurements taken with a chain or a tape.

- As a magnetic compass is not precise angle measuring instrument, ∴ compass surveys are not very accurate, however, they are more accurate than chain surveys.

• Compass are generally used to run a traverse in the field.

- In surveying traverse is a framework consisting of series of straight lines forming a open or a closed polygon.



2) Local attraction : It is the attraction of Magnetic Needle to a local Magnetic field other than Magnetic field

- It is caused by iron material nearby compass station.
Ex - Iron pipe, Iron fence, Steel vehicle, Iron deposit, Transmission line, etc.
- To determine local attractⁿ it is mandatory to take fore bearing & Back bearing of each survey line.
- If the difference b/w F.B & B.B $\neq 180^\circ$ then local attractⁿ is expected at 1) Either the station A or B
2) At both stations A and B
- If $FB - BB = 180^\circ$, then both the stations are free from local attractⁿ.

Q Compare salient features of Prismatic Compass & Surveyor Compass.

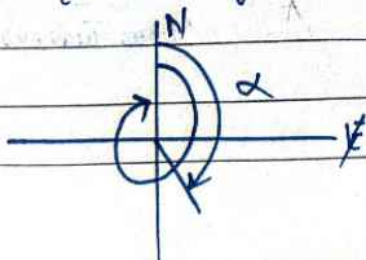
PRISMATIC COMPASS

In this compass bearing is measured from 0° to 360°

Bearing measured is called whole circle bearing

In prismatic compass bearing is in clockwise directⁿ only.

Bearing is measured from North directⁿ



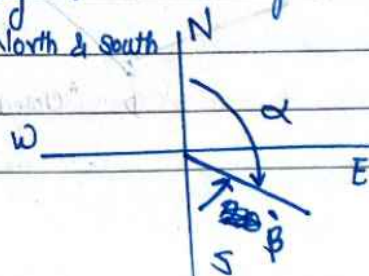
SURVEYOR COMPASS

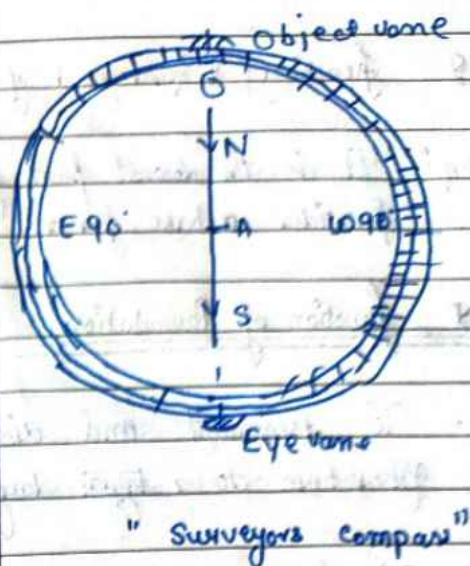
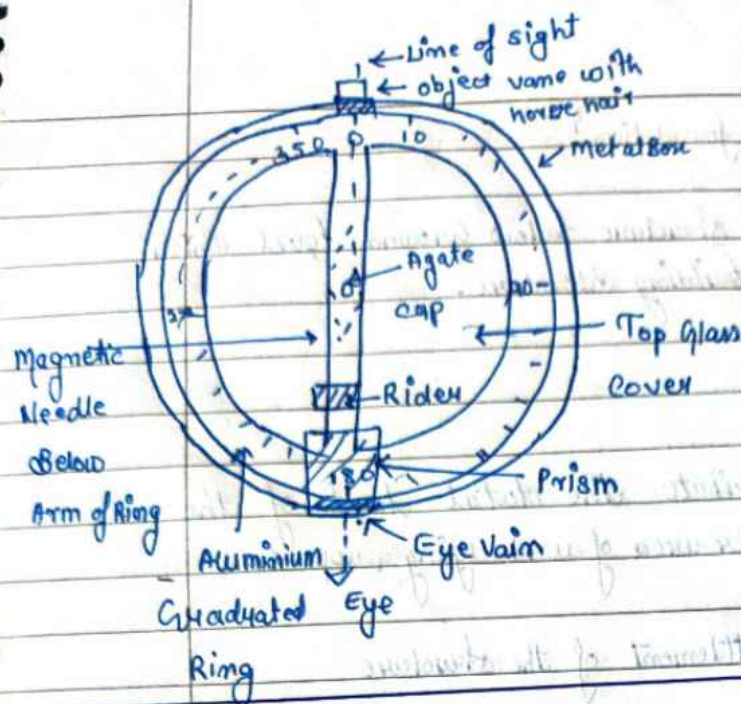
In surveyor compass bearing is measured from 0 to 90°

Bearing measured is called reduced bearing (Quadrantal bearing)

In surveyor compass bearing is in both clockwise & anticlockwise directⁿ

Bearing is measured from both directⁿ North & South





Q Differentiate between Plane & Geodetic Surveying.

	PLANE SURVEYING	GEODETTIC SURVEYING
1	Here, Curvature of Earth is ignored.	Here, Curvature of earth is taken into consideration.
2	It is used for relatively smaller areas (less than 250 km^2).	It is used for establishing large areas.
3	It is used for establishing less important points.	It is used for establishing precise of reference or control points.
4	The Direc ⁿ of Plumb lines at various points is assumed to be // to one another.	The direc ⁿ of Plumb lines at various points are different.
5	Standard of accuracy is lower than in Geodetic Surveying.	The Standard of accuracy is very high. Very precise instruments are used.
6	Done for local surveys.	Done by Survey of India.

Q Function & Requirement of foundation?

• Foundation: It is the lowest part of structure below ground level which provides a base for a building structure.

* Function of foundation

- To transmit and distribute the total load of the structure to a ~~larger~~ larger area of underlying support.
- To prevent differential settlement of the structure.
- To provide stability to the structure.
- Foundation support the structure.
- It provide safety to the structure against undermining or scouring due to animals, flood water etc.
- It provide leveled & hard surface to the superstructure over which superstructure, can be built.
- To secure a level & firm bed for building operations.
- To prevent lateral movement of the supporting material.
- To inc. the stability of the structure as a whole.

* Requirement of foundation

1. Location of foundation should be selected such that it can safely transfer load as per design with considering future expansion.
2. Good designed foundation should resist earthquake pressure, landslide pressure etc.
3. A good foundation should avoid overturning of buildings.
4. A good foundation should be strong as well as economical.
5. For good foundation, area below foundation should be drained properly.
6. A good foundation should consider environmental & other factors
Ex - soil, ground water & soil erosion.

9 Explains Biodiversity : Threats to biodiversity & Conservatⁿ of it.

Solⁿ Biodiversity refers to the variety of living species on Earth including plants, animals, bacteria & fungi.

Types of Diversity : 1) Genetic Biodiversity 2) Species Biodiversity 3) Ecosystem Biodiversity

- 1) Genetic Biodiversity : This type of Diversity takes place due to variation of genes with species. Genes are basic of units of this Diversity.

The genetic diversity is expressed in the forms of breeds, races, varieties & form.

Eg - In Dogs, In case of humans, Different colours of Butterfly.

2) Species Biodiversity: Variability within the populatⁿ of a species or b/w different species of community

Species diversity is the no. of different species that are represented in a given community

Eg- Every human / animal / birds looks diff^r from each other.

3) Ecosystem Biodiversity: Variations in the plant and animal species together & connected by food chains & food webs.

eg: Diversity in diff^r ecosystem like desert, rainforest, mangroves etc include ecological diversity.

* Importance / Value of Biodiversity

1) Ecological Services Provided by Biodiversity are -

- Ecosystem stability
- Nutrient Recycling
- Energy Transfer
- Climate stability
- Pollutant Breakdown
- Balance of atmospheric gases.

2) ~~Food~~ Biological Services provided by Biodiversity are -

- food
- Pharmaceutical Drugs
- Ornamental plants
- Wood products
- Breeding stocks
- Diversity in genes of species.

3) Social Services provided by Biodiversity are -

- Research
- Education
- Cultural Values
- Sacred Plants
- Tourism

• Threats to Biodiversity - $\left\{ \begin{array}{l} \text{Habitat loss} \\ \text{Poaching of wildlife} \\ \text{Natural Calamities.} \end{array} \right.$

• Conservation of Biodiversity.

→ Conservation involve protection, preservation & management of Biodiversity.

→ Conservation means management of man's use of Biosphere in such a way that maximum benefit is obtained by the present generation, while maintaining its potential to meet the requirement of future generation.

Q Role of individual in conservation of Natural Resources.

Ans • Natural Resources are natural assets (raw material) occurring in natural environment that can be used for economic production by humans to sustain their life.

; Some resources such as air, water, food & land are important because without them life can't be sustained. They are called as life supporting systems.

* Conservatⁿ of Water

1. Close the water taps when not in use.
2. Toilets which saves water should be used.
3. Pipes & toilets should be regularly checked.
4. Waste water from washing should be reused.
5. Plants & trees around the house can be watered.
6. ~~The plants~~ Sprinkling Irrigation method should be used.
7. Rainwater collectⁿ system should be used.
8. Proper Rainwater harvesting Method should be implied.

* Conservatⁿ of Energy

1. Solar Power supply can be used for electrical purposes.
2. Houses should be designed to recie proper light
3. Deciduous trees & timber should be grown
4. Glass, Metals & paper should be recycled.
5. Public Transportatⁿ should be used.

Q Write short Notes on (i) Nuclear Waste (ii) E-Waste

Ans (i) Nuclear Waste are wastes that contains radioactive material. Nuclear waste are usually by products of Nuclear power generation & other applications of nuclear fission or Nuclear Technology.

* Classification of Nuclear Wastes -

1. On the basis of State

{	Solid waste
	Liquid waste
	Gaseous waste
2. On the basis of Radioactivity

{	High level Waste (3%)
	Medium level waste (7%)
	low Medium waste (90%)

1) High level waste:

- Large amount of radioactive activity & is thermally hot.
- 3% volume of waste
- 95% of Radioactivity
- Current levels of HLW are increasing about 12,000 metric tons/year
- Most HLW consist of Pu-238, 239, 240, 241, 242, Np-237 & U-235

2) Medium level waste:

- Requires shielding when being handled.
- 7% of Volume of Wastes
- Dependent on the amount of activity it can be buried in shallow repositories.
- These wastes are mainly contaminated with neutron activation product isotopes.

3) Low level Radioactive waste:

- Consists of:
 - 1) Contaminated Solids
 - 2) Liquids
 - 3) Animal Carcasses
 - 4) Small sealed sources

- Radioactive animal carcasses are either incinerated or buried on site.
- The Nuclear waste is cast in cements in steel drum &
- are buried or kept at the bed of oceans.
- 90% of waste are of low level quality.

2) E-Waste : E. Waste otherwise known as Electronic Waste, or Waste Electrical & electronic equipment (WEEE) or End-of-Life Electronics (EOL)

- E waste are electronic devices which has no longer value for its owner.

eg - Refrigerator, Air conditioner, Cell-Phone, Personal stereos, Consumer Electronic, Computer which have been discarded by their users.

* In India, e-waste is categorized into two groups

1. Information Technology & Telecommunication Equipments.
2. Consumer Electrical & Electronics.

* In General, e-waste is divided into five groups.

- 1) Ferrous Metals
- 2) Non-ferrous Metals
- 3) Glass

- 4) Plastic
- 5) Others.

→ Iron & Steel (half the total wt. of WEEE) nearly 48%.

- Plastic - 21% of weight

- Non-ferrous metals including precious metal → 13% of which Cu → 7%

Challenges:

- Presence of toxic & valuable metals
- High cost of repair & comparatively low cost of electronic items.
- Recycling is expensive
- Less space in landfill
- Improper Methods of Dismantling
- Lack of Proper Regulation.

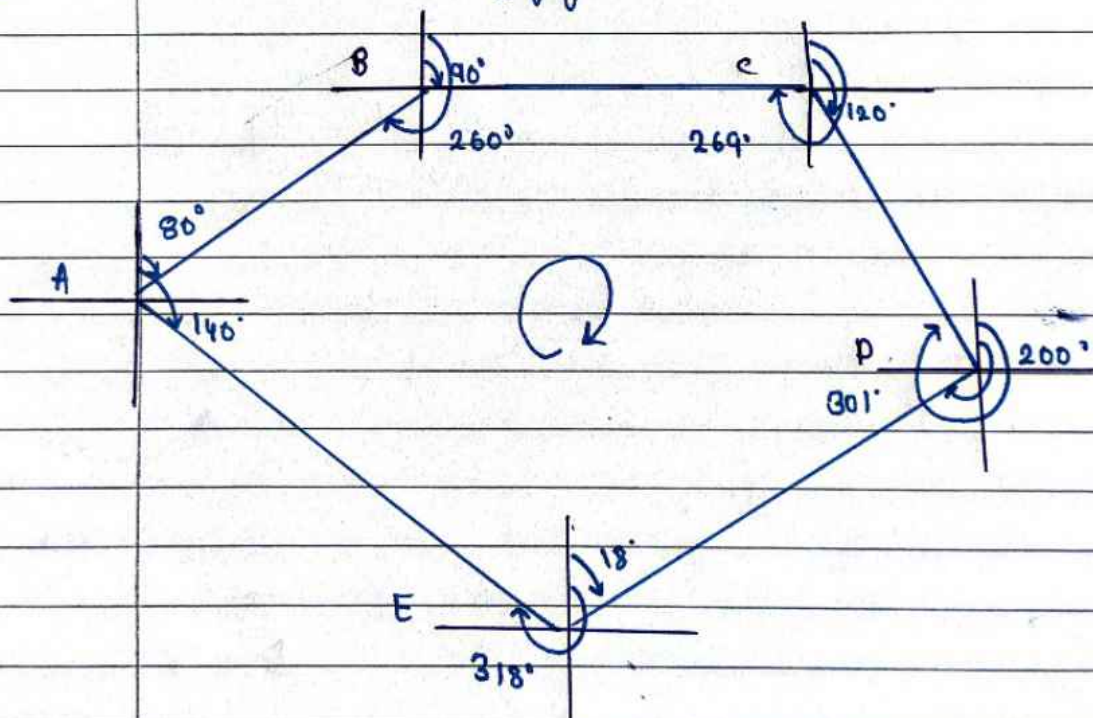
Ques

In running a closed traverse ABCDE, the following bearings were observed with a magnetic compass?

Station	Fore Bearing	Back Bearing	Diff ^y
A	80°	260°	180°
B	90°	269°	179°
C	120°	301°	181°
D	200°	18°	182°
E	318°	140°	178°

At which station do you suspect local attractions? Calculate the correct included angles. also determine correct FB & BB of all lines

Solⁿ STEP-1, Plot the traverse (Roughly)



* Only stations A, B & D free from local attraction.

At stations C & E, local attraction phenomena is suspected.

STEP-2

Calculation of the observed interior angles

$$\theta_A = 140^\circ - 80^\circ = 60^\circ$$

$$\theta_B = 260^\circ - 90^\circ = 170^\circ$$

$$\theta_C = 269^\circ - 120^\circ = 149^\circ$$

$$\theta_D = 801^\circ - 200^\circ = 101^\circ$$

$$\theta_E = 18^\circ - 318^\circ = -200^\circ \rightarrow 360^\circ - 200^\circ = 160^\circ$$

Step-3

Calculatⁿ of Corrected included Angles.

$$\begin{aligned} \text{Summat}^n \text{ of Observed included angles} &= 60^\circ + 170^\circ + 149^\circ + 101^\circ + 160^\circ \\ &= 540^\circ \end{aligned}$$

Ideally the Summatⁿ of included angles should be 540° acc. to formula $(n-4) \times 90^\circ$

→ Since the Summatⁿ of Obs^v inc. angles is acc. to respective formula
∴ the obs^v interior angles are correct.

Step-4

Identificatⁿ of Reference line → Since diffⁿ of FB & BB of line AB = 180°
Compute diffⁿ of FB & BB
ie (FB - BB)

∴ it is taken as reference line

Step-5

Calculatⁿ of the corrected Magnetic Bearings.

$$\begin{aligned} \rightarrow \text{Correct FB of line BC} &= \text{BB of line of AB} - \theta_B \\ &= 260^\circ - 170^\circ = 90^\circ \end{aligned}$$

$$\text{Corrected BB of line BC} = 90^\circ + 180^\circ = 270^\circ$$

$$\rightarrow \text{Corrected FB of line CD} = \text{BB of line BC} - \theta_C = 270^\circ - 149^\circ = 121^\circ$$

$$\text{Corrected BB of line CD} = 121^\circ + 180^\circ = 301^\circ$$

$$\rightarrow \text{Corrected FB of line DE} = \text{Corrected BB of line CD} - \theta_D = 301^\circ - 101^\circ = 200^\circ$$

$$\text{Corrected BB of line DE} = 200^\circ - 180^\circ = 20^\circ$$

$$\rightarrow \text{Corrected FB of EA} = \text{Corrected BB of DE} + \angle E = 20 + 60^\circ = +40^\circ$$

$$-40^\circ + 360^\circ = 320^\circ$$

$$\text{Corrected BB of EA} = 320 - 180^\circ = 140^\circ$$

Q A line was measured with a steel tape of 30m length, which was standardised for a pull of 5kg. The length of line was found to be 67.0m. If the actual pull during measurement was 10kg. Determine T.L of line. Cross-sectional Area of tape is 0.02 cm^2 & Modulus of elasticity of tape is $2.1 \times 10^6 \text{ kg/cm}^2$

Solⁿ $\rightarrow$ Correction due to pull, $C_p = \frac{(P - P_0)L}{AE}$

Here $P = 10 \text{ kg}$

$$P_0 = 5 \text{ kg}$$

$$L = 30 \text{ m}$$

$$A = 0.02 \text{ cm}^2$$

$$E = 2.1 \times 10^6 \text{ kg/cm}^2$$

$$C_p = \frac{(10 - 5) \times 30}{2.1 \times 10^6 \times 0.02} = 0.0036 \text{ m}$$

$$\text{Correct length of tape} = 30.0036 \text{ m}$$

$$\text{T.L of measured line} = \frac{\text{Actual length of chain}}{\text{Nominal length of chain}} \times \text{Measured Distance}$$

$$= \frac{30.0036}{30} \times 67.0$$

$$\text{T.L of measured line} = 67.008 \text{ m}$$

Q

With a 80m tape, which measures exactly 80m at 27°C, the length of the line was calculated as 850.420 m. Find the correct length of the measured line. Take the coeff of thermal expansⁿ $\alpha = 1.16 \times 10^{-5}/^\circ\text{C}$. The field temp. was 32°C.

Solⁿ $\Rightarrow$

Correcⁿ Due to Variatⁿ in Temp., $C_t = \alpha (T - T_0) L$

Here $\alpha = 1.16 \times 10^{-5}/^\circ\text{C}$

$$T = 32^\circ\text{C}$$

$$T_0 = 27^\circ\text{C}$$

$$L = 850.420$$

$$\begin{aligned} C_t &= 1.16 (32 - 27) \cdot 850.420 \\ &= 0.049 \text{ m} \end{aligned}$$

$$\begin{aligned} \rightarrow \text{Correct Measured length} &= 850.420 \text{ m} + 0.049 \text{ m} \\ &= 850.469 \text{ m.} \end{aligned}$$

Q

Explain fundamental lines of levelling & Relatⁿ B/w them

Q Discuss Various types of Maps & their uses?

Ans Different types of Maps are -

1) Cadastral Map:

a) It is a detailed Map.

b) It plans out individual property. Providing details such as Boundary information when houses & lands are surveyed. The whole information is combined to make bigger cadastral Map.

Uses - Used for planning, cities, societies, colonies or any industrial area.

2) Topographical Map

a) It is more like a physical Map because it indicates diff. physical landscape feature.

b) These maps uses contour lines rather than colour to show change in Deviation line.

Uses - Camping, fishing, hiking, Urban planning, resource managing and surveying.

Properties - They show true nature of ground that include, mountains, rivers, valley, hills etc.

3) ~~Political Map~~ Engineering Map - used to Represent Eng. structures like Dam, railway, canal.

4) Geodetic Map - used to present what lays in beneath the surface of Earth like Natural Resources.

5) Hydrological Map: used to Represent Water Bodies acc. to Nature like river, pond, tubewells etc

10

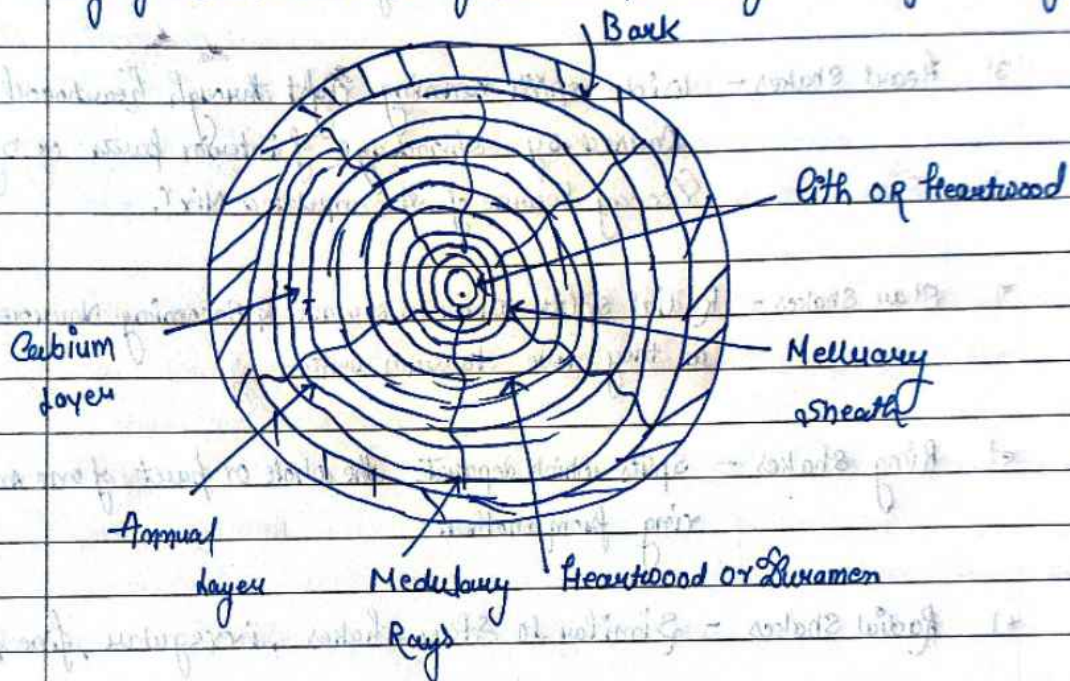
Draw a neat sketch of Exogenous tree.

solⁿ

Exogenous trees - Trees that grow outwards by the addition of one concentric ring.

These rings are known as annual rings because one such ring is added to the tree every year.

Age of the tree can be found out by counting the no. of such rings.



11

Describe in brief various defects in timber.

* Defects Developed During the growth of tree

- | | |
|------------------------------|------------------|
| 1) Knots | 6) Radial shakes |
| 2) Twisted fibres | 7) Rupture |
| 3) Heart shakes | 8) Ring galls |
| 4) Star shakes | 9) Blind check |
| 5) Ring shakes or cup shakes | 10) Fomices |
| 11) Coarse grains. | 11) Lateness |
| | 12) Bruising. |

* Defect developed after the tree has been felled.

1) Dry Rot - Attack on Timber by fungus

2) Wet Rot - Decay of timber due to alternate wetting & drying
— GROWTH

3) Knots - Roots of small branches of tree

4) Twisted fibres - Due to Action of wind

5) Heart shakes - Wide splits running right through heartwood.
Caused by shrinkage of interior parts or by decay because of accumulated Moist.

6) Star shakes - Radial splits wider on surface & becoming narrower as they move towards centre

7) Ring shakes - Splits which separate the whole or part of one annual ring from another.

8) Radial shakes - Similar to star shakes, irregular, fine & numerous

9) Rupture - Caused due to fibres having been injured by crushing.

10) Resin Galls - 1) Foxiness - Presence of Reddish or Yellowish stains

2) Boilermans - Speckled stain

3) Resinosis - Presence of white spots.

Que

Explain diff^r types of Brick?

Ansⁿ

Classification of Bricks

first class Bricks

Second class Bricks

Third class Bricks

fourth class Bricks.

1) first : These Bricks are table moulded, of standard shape & they are Class Bricks Burnt in kilns.

- The surface & edge of Bricks are sharp, square, smooth & straight.
- They comply with all the qualities of good Bricks.
- These Bricks are used for superior work of permanent nature.

2) Second : These Bricks are ground moulded & they are burnt in kilns

Class bricks The surface of these bricks is somewhat rough & shape is also slightly irregular

- These Bricks may have hair cracks & their edges may not be sharp & uniform

These bricks are commonly used at places where brick work is to be provided with a coat of plaster.

3) Third : These bricks are ground moulded & they are burnt in clamps.

Class Bricks These bricks are not hard & they have rough surface with irregular & distorted edges.

- These bricks give dull sound when struck together.
- They are used for unimportant work & at places where rainfall is not heavy.

4) fourth : Over burnt bricks with irregular shape & dark colours.

Class Bricks Used as aggregate for concrete in foundation, floor, roads etc.

Badly distorted in shape & size

Brittle in nature.

Que

Explain self purification of streams?

Ans

Various Natural forces of purification are -

- | | |
|--------------------------|--------------------|
| 1) Dilution & Dispersion | } Physical forces |
| 2) Sedimentation | |
| 3) Sunlight | } Chemical forces. |
| 4) Oxidation | |
| 5) Reduction | |

1. When sewage effluents are discharged into large volume of water contained in the river stream, it gets rapidly dispersed & diluted.
- This action results in diminishing the concentration of organic matter & thus reduces the potential nuisance of sewage.
2. The suitable solids will settle down into the bed of the river, near the point of disposal or outfall thus helping in "self purification" process.
3. The evolution of oxygen in river water due to sunlight will help in achieving "self purification" through oxidation.
4. The oxidation of organic matter will start as soon as sewage outfalls into the river water.
- This process continues till the organic waste has been completely oxidised.
5. It occurs due to hydrolysis of organic matter settled at the bottom either chemically or biologically.

Que

Explain manufacturing of cement By wet process with help of flow Diagram.

